

Endogeneity in the European import demand for soybean: the role of Genetically Modified Organisms

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Soybeans and soybean meal in the EU

Limited European supply:

- unfavorable climate in most MSs;
- frequent changes in CP have addressed farmers' decisions (Bertheau and Davidson, 2011).

High demand supported through import:

- grains: 14.5 mmt annual avg. during 2005-2014;
- main exporters: BR (47%), USA (35%), PRY (10%), CAN (7%);
- meal: 21 mmt annual avg. during 2005-2014;
- main exporters: BR (47%), ARG (35%), USA (9%), PRY (1.5%).

Soybean source differentiation

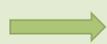
Imperfect substitution due to source-specific features, i.e: different reputations for product's quality, quality consistency, reliability, supply chain management, etc. (Washington and Kilmer, 2002).

The case of soybean: different exporters typically have

- different GM approval statuses (AA);
- uneven supply chain management systems
- Products with different nutritional characteristics (Grieshop and Fahey, 2011)

GMOs:

- New varieties fastly introduced in exporting countries
- National GMO regulations



Asynchronous
Approval (AA)

EU «zero tolerance policy» + AA → Trade disruptions → need for effective upstream product management.

Objectives

- Provide up-to-date cross-country import elasticities for soybean;
- exploit a theoretical specification derived from producer theory;
- take into account exporter-specific characteristics which might impact import prices, but generally unobserved in structural demand models.

Model Specification

Prices for differentiated products typically incorporate demand and supply characteristics: price endogeneity may arise in demand systems whenever some of the price determinants involve unobserved demand characteristics (Dhar, 2003).

First stage: regress unit prices on a vector of source-specific characteristics.

Regressors' choice: general contributions such as Clark et al. (2004), Beverelli et al. (2010), Faria and Wieck (2014,2015), Henseler et al. (2013), Harri et al. (2009).

$$p_{it} = \alpha_0 + \alpha_1 p_{it-1} + \alpha_2 DIST_i + \alpha_3 OIL_t + \alpha_4 AA_{it} + \alpha_5 SCE_{it} + \alpha_6 q_{it-1} + \alpha_7 q_{it-1}^2 + \alpha_8 ER_{it} + v_{it}$$

AA_{it} is defined according to De Faria and Wieck, (2015)

$$AA_{it} \equiv \frac{1}{M_t} \left(\sum_{m_t=1}^{M_t} \exp \frac{(R_{im_t} - R_{m_t})}{\max\{R_{m_t}\} - \min\{R_{m_t}\}} \right)$$

Second stage: Differential Factor Allocation Model (Laitinen and Theil, 1978), following Washington and Kilmer (2002), Christou et al. (2005), Muhammad and Kilmer (2008).

$$\bar{h}_{it} \Delta q_{it} = \theta_i \Delta Q_t + \sum_{j=1}^N \pi_{ij} \Delta p_{jt} + \gamma_i \Delta \hat{v}_{it} + e_{it}$$

Import allocation decision of country i as a function of other countries' relative prices and Divisia index (total input decision).

- $j = \{1,2,3,4\} = \{USA; BR; CAN; PRY\}$
- $T = 56$: 14 years, quarterly data.

Data

- Price, quantities and values: quarterly time series (2000-2013) from Eurostat Trade dataset (Eurostat, 2013);
- variables in the price regression: World Bank (2015), Faostat (2015);
- index of asynchronous approval: data from ISAAA, CERA and Biotechnology Industry Organization.

Estimation Results

First-stage:

- price equation estimated through HAC-POLS
- AA_{it} , $DIST_i$, OIL_t significant at 1-5%
- q_{it-1}^2 indicates the presence of economies of scale

Second-stage:

- Homoskedastic system FGLS with symmetry and homogeneity imposed.
- Conditional Hicksian elasticities: $\varepsilon_{qip_j} = \pi_{ij} h_i^{-1}$, $\eta_{qiQ} = \theta_i h_i^{-1}$

Conditional own-price and cross-price elasticities					
	Divisia Index	US	Brazil	Canada	Paraguay
US	1.5044 *** (s.e.) (.4556)	-4.5597*** (1.3203)	2.4470*** (1.1340)	-3.5750** (0.2745)	1.8180 * (0.3253)
Brazil	.1023 (s.e.) (.1851)		-2.8849*** (.5679)	7.5435*** (2.0554)	-1.9291 (1.2478)
Canada	1.5220 *** (s.e.) (.4119)			-5.2887** (2.0085)	.8117 (.6156)
Paraguay	-.1146 (s.e.) (.3359)				-.7006 (1.0581)

Conclusions

Residuals significant at 5% and 10% in the equation for the USA and PRY: prices endogeneity detected (but very weak in PGY).

- Complementarity between USA/CAN and BR/PRY;
- substitution between South America and North America;
- USA and CAN share a number of country and product-specific characteristics; the same is true for BR and PRY (less trivially);
- cross-price elasticities put less weight on soybean country-specific characteristics and place more emphasis on seasonal/price driven substitution;
- high own-price elasticities corroborate this result.

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